# P-4.3 Summarize current, potential difference, and resistance in terms of electrons

**Revised Taxonomy Level 2.4 <u>Summarize</u> conceptual knowledge**

**Key Concepts**
Current, amp - Potential difference, - Resistance, ohm

In physical science students "Explain the relationships among voltage, resistance, and current in Ohm's law (PS-6.6) and Use the formula V = IR to solve problems related to electric circuits. (PS-6.7) In order to explain the relationship among voltage, resistance, and current students addressed the nature of these variables in terms of moving electrons.

**It is essential for students to**

- Understand the concept of *current* (symbol I) as the rate of flow of electric charge (Q)
  - $I = \Delta Q/\Delta t$
  - Electric current is measured in units of coulombs per second, I = C/s
  - One *ampere* (symbol A) is defined as a flow of one coulomb of charge per second
- Understand *electric potential energy* as the energy that a charge has due to its location in an electric field.
- Understand the concept of *electric potential* as the electric potential energy per coulomb at a location in an electric field
  - Electric potential is a measure of the potential energy per charge, and has units of joules/ coulomb
  - One *volt* (symbol V) is defined as one joule/coulomb
  - If an electric potential causes a charge to move, the voltage can be described as the work per charge.
- Understand the concept of *electric potential difference* as the difference in electric potential (voltage) between two points.
  - Free charge well flow when there is a difference in electric potential, and will continue until both points have the same potential.
- Understand the concept of *electric resistance* as the resistance of a material to the flow of electric current, measured in units of ohms (Ω)
  - One *ohm* (symbol Ω) is defined as the resistance of a material that allows a current of one ampere to flow when a voltage of one volt is impressed across it.

**Assessment**
The revised taxonomy verb, summarize, means "to abstract a general theme or major point" For this indicator, the major focus of assessment should be to insure that students have a deep conceptual understanding of the terms potential difference, current, and resistance. Understanding the way that these units are derived is an important part of the understanding of these terms. Conceptual knowledge requires that students understand the interrelationships among the basic elements within a larger structure that enable them to function together. In this case, that students understand the effect that each of the three variables (potential difference, current, and resistance) has on the others.